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Microporous heat insulation body

The subject matter of the present invention is a microporous heat insulation body consisting of a core of compressed heat insulation material containing from 30 to 90 % by weight of a finely divided metal oxide and further additives, wherein one or both surfaces thereof have a cover from a heat-resistant material.

Heat insulation bodies have been described, e.g., in EP-A-0 618 399, wherein, however, at least one surface of the formed piece is required to have channel pores having pore base areas of from 0.01 to 8 mm² and penetration depths of from 5 to 100 %, based on the thickness of the formed piece, and wherein the surface of the formed piece contains from 0.004 to 10 channel pores per 1 cm².

Said heat insulation bodies are manufactured by a dry compression and a subsequent sintering at temperatures of from 500 to 900 °C with the channel pores being formed by drilling, punching, or milling and preferably by embossing punches. Due to these measures, it is possible to drain off the steam explosively escaping during the rapid heating such that a decomposition of the heat insulation body can be avoided.

The drawbacks of said heat insulation body are the complicated manufacturing process and the deterioration of the heat insulation properties due to the convection of gases within the pores.

Another process for the manufacturing of a microporous body has been described in EP-A-0 623 567, wherein oxides, hydroxides, and carbonates of the metals of the 2nd main group of the periodic system are compressed together with

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Heat insulation bodies prepared with highly heat-resistant adhesives and a slurry, a silica sol and a clay have been described in DE-C-40 20 771. Herein, also additional prior art regarding the manufacturing and composition of heat insulating bodies has been described. The drawback of all heat insulation bodies comprising organic components and in particular organic fibrous material is that said organic components burn at very high temperatures and feature an unwanted evolution of gas.

DE-C-42 02 569 describes moulds for pressing heat insulation bodies, in particular for electrical radiant heaters such as boiling plates.

Said heat insulation plates have another drawback in that it is difficult to avoid damaging the outer layers during cutting and processing steps unless very expensive tools such as laser cutters are used since said cutters are capable of vitrifying the freshly formed cut edges.

Finally, the heat insulation bodies are required to be good electrical insulators in many cases. However, there exist uses where it is desired that at least one of the surfaces has an electrical conductivity to be able to dissipate electrostatic charges.

All these problems have been solved by microporous heat insulation bodies consisting of a compressed heat insulation material containing from 30 to 90 % by weight of finely divided metal oxide, from 0 to 30 % by weight of an opacifier, from 0 to 10 % by weight of an inorganic fibrous material, and from 0 to 15 % by weight of an inorganic binder, wherein the body additionally contains from 2 to 45 % by weight, preferably from 5 to 15 % by weight of xonotlite. Said heat insulation bodies are the subject matter of DE 198 59 084.9.

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Preferably, said microporous heat insulation body has a cover of a heat-resistant material on one or both surfaces thereof. Especially preferred are covers which are the same or different and consist of rough-pressed xonotlite, prefabricated mica or graphite sheets. With the use of xonotlite and/or mica covers being good electrical insulators are formed. With the use of graphite there is formed a cover which has a conductivity enabling at least the dissipation of electrical charges. Thus, in certain uses it may be advantageous to form one side of the cover from xonotlite and/or mica and the other cover from graphite.

Now, it has been established that covering porous heat insulation bodies with prefabricated mica sheets considerably improves the properties of heat insulation bodies in two different ways, that is, with regard to the thermal conductivity as well as the mechanical properties, in particular the bending strength. At first, this has been established with internal tests of the microporous heat insulation bodies according to DE 198 59 084.9. However, in addition to this it has been established that a covering with prefabricated mica sheets considerably improves other microporous heat insulation bodies as well. Thus, the subject matter of the present invention is a microporous heat insulation body consisting of a core of compressed heat insulation material containing from 30 to 90 % by weight of finely divided metal oxide and further additives, wherein one or both surfaces thereof have a cover of a heat-resistant material, characterized in that the covers are the same or different and at least one side consists of prefabricated mica sheets.

Preferably, the cover consists of a prefabricated mica sheet on both sides.

Above all, the improved mechanical properties become apparent in heat insulation bodies having a distinct flexibility due to the thickness thereof. Thus, heat insulation bodies having a thickness of from 3 to 10 mm, preferably from 5 to 7 mm, are especially preferred.

Moreover, heat insulation bodies wherein the cover is adhered to the core have been proved especially efficient. As adhesives, both inorganic adhesives such as water glass and organic adhesives such as polyvinyl acetate are possible. When heating the finished microporous heat insulation bodies, the low amounts of processed organic substance do practically not impair the properties of said material.

In principle, it is possible to heat-seal the core and the mica sheets together within a film, in particular a shrink film, instead of adhering them. Such microporous heat insulation bodies also have an improved heat insulation, an improved mechanical stability and a better bending strength than the products according to, e.g., EP-A-0 829 346.

The invention will be illustrated in more detail in the following examples and comparative examples.

A mixture of 63 % by weight of pyrogenic silicic acid, 30 % by weight of rutile, 2 % by weight of silicate fibres (6 mm in length), and 5 % by weight of synthetic xonotlite were dry-mixed in a compulsory mixer and then dry-compressed in a metal mould with the pressing pressure varying between 0.9 and 7.0 MPa. This way plates having densities between 300 and 560 kg/m³ were obtained. The

bending strength varied between 0.1 MPa and 0.8 MPa as a function of the density. The values are illustrated in Figure 1.

Furthermore, the λ values (thermal conductivity in $W/(m \cdot K)$) as a function of the temperature were determined employing a isolated hot plate according to DIN 52 612.

The above-mentioned plates were coated with a 0.1 mm thick mica sheet on both sides and adhered with a commercial organic adhesive on the basis of PVA (polyvinyl acetate). The mica sheets are a commercial product of the Cogebi company, Belgium.

The plates thus obtained were tested for bending strength and thermal conductivity. The results are summarized in the following tables and illustrated in Figures 1 and 2:

Reference example		Sandwich containing a mica sheet of 0.1 mm.	
Density (kg/m^3)	Bending strength (MPa)	Density (kg/m^3)	Bending strength (MPa)
300	0.10	298	0.43
387	0.19	379	0.80
382	0.23	412	1.10
344	0.10		
424	0.25		
560	0.80		

Reference example		Sandwich containing a mica sheet of 0.1 mm	
Temperature (°C)	λ (W/(m °K))	Temperature (°C)	λ (W/(m °K))
20	0.026	220	0.025
200	0.028	620	0.034
600	0.040	400	0.028
800	0.048		